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EVALUATION OF TYPE II FAST PACKS FOR ELECTROSTATIC  
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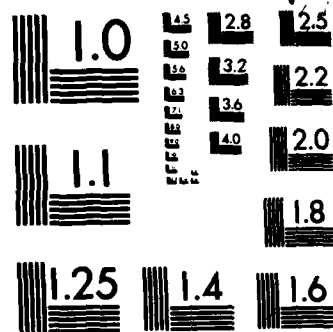
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EVALUATION OF TYPE II FAST PACKS  
FOR ELECTROSTATIC DISCHARGE PROPERTIES

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AIR FORCE PACKAGING EVALUATION AGENCY  
WRIGHT-PATTERSON AFB OH 45433

August 1983

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## ABSTRACT

A commercially available cushioned, fiberboard pack was evaluated for both its electrostatic protection properties as well as its shock and vibration characteristics with regard to the critical protection of sensitive electronic components. The cushioning performance of the pack was compared with that of a similar size standard Type II Fast Pack (PPP-B-1672). The results of this evaluation indicated that the pack provided cushioning protection which, on average, was comparable to that obtained with the standard Type II Fast Pack. Using as a reference base, the static charge built up on a standard Type II Fast Pack, which contains no antistatic treated materials, it was determined that the pack having electrostatic protection properties avoided the development of electrostatic fields which measured as high as 4.5 KV in the standard pack. Other concepts are also currently being considered for providing electrostatic protection for the Type II Fast Pack. These include the use of conductive carbon impregnated polyurethane foams as well as foams treated with antistatic materials.

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## INTRODUCTION

ADE, Inc., Chicago, Illinois requested consideration of their Cancel Caddy Pack for protecting fragile electronic components from harmful static electricity as well as mechanical shocks.

## TEST PACKS

The Cancel Caddy Pack (Figure 1) is a reusable, single wall fiberboard pack (12" x 8" x 1 3/4") consisting of a reclosable cushioned carrier which mates into an outer fiberboard sleeve. A cushioning insert is used consisting of a polyethylene (anti-static treated wrap) material of extruded hexagonal airtight cells. The packs cushioning performance was rated for loads weighing up to one pound.

The PPP-B-1672, Type II, Fast Pack (Figure 2) is a reusable, single wall fiberboard pack (12" x 8" x 2 1/2") consisting of an inner slide and outer sleeve. The cushioning insert consists of polyurethane convoluted foam, Type I, Class 2, Grade B complying to MIL-P-26514E.

## TEST LOAD

The simulated test load consisted of a masonite board (1/4" x 6" x 4 1/2") on which were mounted wooden shapes, representing solid state devices, and aluminum wiring to simulate a typical printed circuit board. Its weight was varied by adding additional masonite plates and components. Three mil thick polyethylene film was wrapped around the test load in order to avoid interference with the cushioning action of the pack inserts. The test load was instrumented with a tri-axial accelerometer.

## INSTRUMENTATION AND EQUIPMENT

The following instrumentation and equipment were employed in this study:

1. Oscilloscope, 4 channel storage, Tektronix Model 564-B.
2. Accelerometer, tri-axial, Endevco, Model 2228C S/N CM55.
3. Amplifier (3 each), Endevco, Model 2614C.
4. Power Supply, Endevco, Model 2622C.
5. Gaynes Drop Tester, Model 125.
6. Electrodynamic Shaker, Unholtz Dickie, Model 640M.
7. Static Sensor Meter, Anderson Effects, Model DCA-1200-1.

## TEST PROCEDURES/RESULTS

Free Fall Drop Test: The test packs were subjected to a 30 inch free fall drop test in accordance with Federal Test Method Standard 101C, Method 5007.1, Procedure B, Level A. A tri-axial accelerometer was secured near the center of gravity of the test load (Figure 1) to record impact shock (G's). The results of the drop tests are presented in Table I.

Vibration Test: The packs with test loads were subjected to a sinusoidal vibration test. The table operating frequency was maintained at 5HZ, 1.0 inch double amplitude for periods of five minutes for each of three pack orientation. The packs were strapped to the vibration table and tested in three different orientations, bottom, end and side surfaces. Immediately after vibration, each pack was opened, and at a distance of approximately six inches from the exposed cushioning surfaces, a hand held static sensor meter was used to measure the charge (KV) of the electrostatic field. The electrostatic field measurements are listed in Table II.

## RESULTS

Prior to vibration, as indicated in Table II, the Cancel Caddy Pack had no electrostatic field charge based on measurements taken six inches from the surface of its cushioning insert; after vibration the static sensor meter also indicated an electrostatic free surface. In comparison, the Type II Fast Pack had an initial electrostatic field charge of 2 KV; however, the final charge after vibration was significantly increased to 4.5 kilovolts.

A comparison of the shock performance (see Table I) indicated that for all drop orientations, the Cancel Caddy Pack provided superior shock isolation in protecting the light (0.2 lb) test load; its shock performance in protecting the medium (0.50) and heavier (1.0) test loads was equivalent to the Type II Fast Pack except when dropped on its largest panel area in which case the shock levels were higher.

Visual inspection of both types of packs, after completion of the free-fall drop and vibration tests, indicated no significant damage to their fiberboard surfaces or cushioning inserts; however, after the first drop, the taped joint on the outer sleeve of the Type II, Fast Pack split open five inches. It was necessary to retape the joint in order to complete the testing. No significant load shift occurred in either pack during the drop and vibration tests.

## DISCUSSION/CONCLUSION

The Cancel Caddy Pack provides an electrostatic free barrier in protecting shock sensitive electronic components from harmful electrical shock.

Even though shock protection levels aren't a requirement in MIL-STD-794 for Type II Fast Packs, it was considered important to evaluate the cushioning performance of both type packs to determine whether the Cancel Caddy Pack would provide shock protection levels comparable to the Type II Fast Pack during handling. Overall, the Cancel Caddy Pack provided adequate cushioning comparable to the Type II Fast Pack.

## FUTURE ACTIONS

Additional approaches being considered for providing electrostatic protection to the Type II Fast Pack are the use of convoluted polyurethane cushion inserts which have been impregnated with either conductive carbon particles or "anti-stat" compounds. In addition, to electrostatic protection and cushioning, costs will be an important factor in determining the approach to be taken.



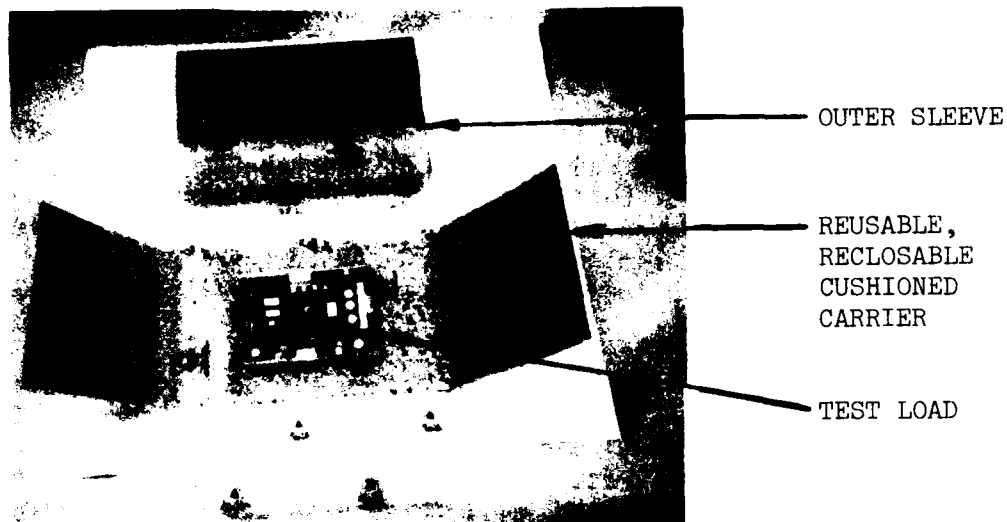


FIGURE 1: Cancel Caddy Pack

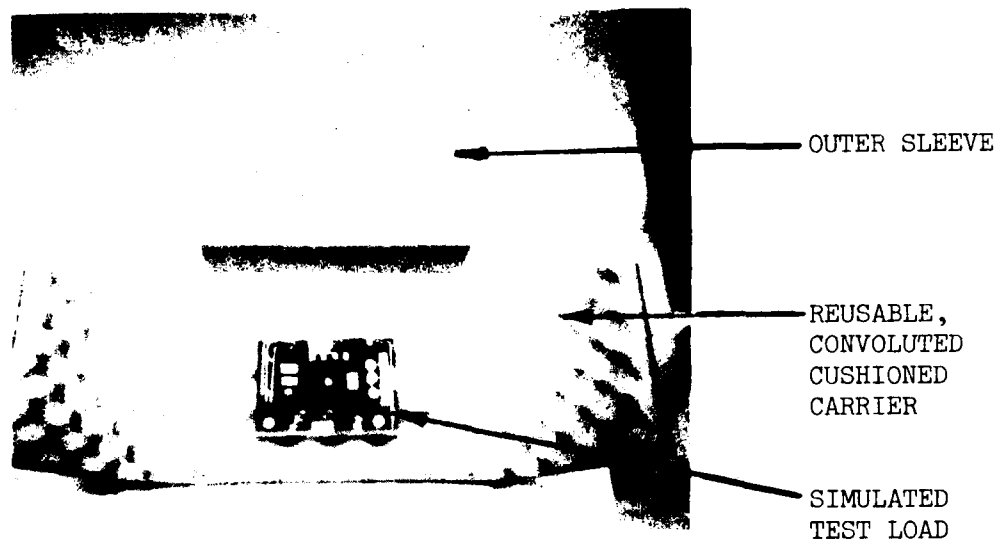


FIGURE 2: Type II Fast Pack (PPP-B-1672)

IMPACT FACE	TYPE II FAST PACK. PEAK Gs			CANCEL CADDY PACK PEAK Gs		
	0.2 lb load	0.5 lb load	1.0 lb load	0.2 lb load	0.5 lb load	1.0 lb load
LARGEST SURFACE	70 Gs	59 Gs	50 Gs	67 Gs	118 Gs	117 Gs
LONG EDGE	88	48	37	42	48	37
SHORT EDGE	107	49	36	42	38	24

TABLE I - PEAK SHOCK LEVELS

TEST	TYPE II FAST PACK	CANCEL CADDY PACK
Initial charge on opened pack prior to vibration test	2 KV	0 KV
Charge around closed pack prior to vibration test.	0 KV	0 KV
Charge on opened pack after vibration test.	4-4.5 KV	0 KV

TABLE II - ELECTROSTATIC FIELD VOLTAGES

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